

**IN THE UNITED STATES DISTRICT COURT
FOR THE DISTRICT OF DELAWARE**

KOOLBRIDGE SOLAR, INC.,
a North Carolina corporation,

Plaintiff,

v.

SOLAREGE TECHNOLOGIES, INC.,
a Delaware corporation,

Defendant.

Case No. _____

JURY TRIAL DEMANDED

COMPLAINT

Plaintiff Koolbridge Solar, Inc. ("Plaintiff" or "Koolbridge"), for its Complaint with Jury Demand for patent infringement against Defendant SolarEdge Technologies, Inc. ("Defendant" or "SolarEdge"), alleging, based on its own knowledge as to itself and its own actions and based on information and belief as to all other matters, as follows:

PARTIES

1. Koolbridge is a corporation existing under the laws of North Carolina with its principal place of business at 710-B Waynick Blvd., Wrightsville Beach, North Carolina 28480.

2. On information and belief, SolarEdge is a corporation organized under the laws of the State of Delaware with its principal place of business at 1 HaMada Street, Herziliya Pituach, Israel. SolarEdge can be served with process by serving its agent, Corporation Service Company, 251 Little Falls Drive, Wilmington, Delaware 19808.

JURISDICTION AND VENUE

3. This is an action for patent infringement under the Patent Laws of the United States, 35 U.S.C. § 101, *et seq.*

4. This Court has subject matter jurisdiction of this action pursuant to 28 U.S.C. §§ 1331 and 1338.

5. SolarEdge is subject to this Court's specific and general personal jurisdiction pursuant to due process and the Delaware Long Arm Statute. SolarEdge has general minimum contacts with this judicial district by being incorporated in this judicial district, by having a place of business in this judicial district, by having an agent to receive process in this district, and/or by transacting business within this district—including at least a portion of the infringements alleged herein, by placing infringing products into the stream of commerce with the knowledge or understanding that such products are sold in the State of Delaware. Personal jurisdiction thus exists over SolarEdge.

6. Venue is proper in this district pursuant to 28 U.S.C. §§ 1391 and 1400(b) as it incorporated in this district, has transacted business in this district, has committed, individually or in concert with others, acts of patent infringement in this district and thus resides in this district.

THE TECHNOLOGY AND INTELLECTUAL PROPERTY

7. Koolbridge is engaged in the business of, among other things, designing, developing, and commercializing solar energy products. Koolbridge was founded in 2013 by, among others, Dr. Paul W. Dent, formerly the Chief Scientist at Ericsson USA. Dr. Dent is a prolific inventor, who has thus far been awarded almost 400 U.S. patents for his various innovations.

8. Dr. Dent initially became interested in solar technology around 1996. He was living in North Carolina when Hurricane Fran hit the area, leaving Dr. Dent and others without power for approximately 10 days. The hurricane also brought down trees and wires, leaving Dr. Dent unable to travel to buy a generator, which were in any case sold out. Dr. Dent realized that a solar

power system would be very useful if he was ever in the same position. Over the next four years or so, Dr. Dent built a solar power system on his property. Through those efforts, Dr. Dent learned much about solar power systems and he believed they could be vastly improved, but he did not then have time to work on those issues.

9. Dr. Dent continued to have an interest in solar power and, when he left Ericsson by early 2010, he began thinking about starting his own solar power business. In connection with those efforts, Dr. Dent conceived several ideas that he described in U.S. Patent Application No. 13/103,070. Dr. Dent subsequently filed additional patent applications related to solar power. One aspect of solar power that Dr. Dent discussed in his patent applications relates to an innovative solar inverter design.

10. A solar system includes one or more photovoltaic ("PV") cells, for example, as part of a solar panel. The energy generated by PV cells is a direct current ("DC"). Most electrical grids in the United States, however, use alternating current ("AC"). Thus, in order to place onto those electrical grids power generated by PV cells, the DC power they generate must first be converted to AC power.

11. Traditional solar inverters use a heavy and inefficient transformer to assist in converting the DC to AC electricity, *e.g.*, by isolating the DC input from the AC output. Alternatively, some inverters use a DC-to-DC converter instead of a transformer, but these devices were also heavy, expensive, and inefficient.

12. In 2013, Dr. Dent and others formed Koolbridge to commercialize his ideas. Koolbridge initially focused on designing a solar inverter, continuing to develop that technology. Eventually, however, Koolbridge reached a place where any further work – *e.g.*, manufacturing and commercialization of the technology – would require substantial additional resources then

unavailable to Koolbridge. Koolbridge instead decided to focus its limited resources on developing commercially its Smart Load Center product. *See* <https://koolbridgesolar.com/smart-load-center/>.

13. It also decided to reach out to other companies in the solar industry, including SolarEdge, to see if they might be interested in a joint development or other arrangement that could bring Koolbridge's solar inverter technology to market.

14. On January 20, 2015, U.S. Patent No. 8,937,822 ("the '822 Patent") was duly and legally issued by the United States Patent and Trademark Office ("USPTO") for an invention entitled "Solar Energy Conversion and Utilization System." *See* Exhibit A, attached hereto and incorporated by reference in its entirety.

15. On September 22, 2020, U.S. Patent No. 10,784,710 ("the '710 Patent") was duly and legally issued by the United States Patent and Trademark Office ("USPTO") for an invention entitled "Transformerless DC to AC Converter." *See* Exhibit B, attached hereto and incorporated by reference in its entirety.

16. Koolbridge is continuing to prosecute in the United States patent applications on this technology, which will be issuing in due course.

17. The '822 and '710 Patents (the "Asserted Patents") teaches and claims novel and nonobvious systems and methods for efficiently converting a direct current ("DC"), electricity typically produced by solar energy collection systems, to an alternating current (AC), electricity typically used and distributed by the electrical grid used in the United States.

18. When installing his own solar energy system after Hurricane Fran, Dr. Dent noted that the transformers needed for traditional solar inverters were both expensive and heavy. A transformer alone can weigh more than one hundred pounds and often require mechanical handling

equipment to move. Use of a transformer also increases the size, weight, and cost of the energy converter. The Asserted Patents describe transformerless solar converters as well as features and functions that enable such converters and improve the efficiency and performance of the DC to AC electricity conversion process.

19. For example, the '822 Patent describes an inverter configured to cause a common-mode voltage to appear on the DC input lines. An inverter as described and claimed in the '822 Patent thus avoids the need to isolate the DC input side of the inverter from the AC output side of the inverter, rendering the transformer unnecessary and decreasing the size, weight, and cost of the solar energy converter.

20. The '710 Patent likewise describes transformerless inverters and thus provides the same size, weight, and cost advantages as above described. In addition, the '710 Patent describes additional features that provide efficiency and performance advantages over traditional solar inverters.

21. For example, the use of multiple switches to generate a multilevel waveform reduces the voltage that power transistors use to switch or the frequency at which they switch. Because switching losses are proportional to voltage times switching speed, reduction of either results in a significant benefit in DC-to-AC conversion efficiency. Efficiency is important because it affects heat dissipation, which is not only wasted energy but also requires additional energy to dissipate. For example, a 5kW inverter with 99% efficiency must dissipate 50 watts of waste power and additional equipment to accomplish this is usually not needed. However, a 5kW inverter with 95% efficiency must dissipate 250 watts of waste heat, which requires cooling fans that in turn require additional power, add weight, create noise, and generally complicate the entire system and the maintenance thereof.

22. In addition, the use of multiple switches to switch different DC input voltages to either add to, subtract from, or not contribute to the resulting waveform allows a multi-level signal to be generated. Because the difference between the multiple voltage levels are smaller than the maximum to minimum voltage difference, less electrical noise is produced when switching between adjacent levels to approximate an intermediate voltage. This noise can interfere with radios or televisions in the home or with utility signaling in the power grid, and as such there are specifications (e.g., UL1741 and FCC Part 15) that must be met. If the noise before filtering is high, the filters will be bigger and more expensive and the efficiency loss through the filters can be greater. Therefore, there is an advantage to having a low noise profile before filtering. All these advantages and more are provided by the inventions claims in the Asserted Patents.

23. Koolbridge is the owner of the Asserted Patents, with all substantive rights in and to those Patents, including the sole and exclusive right to prosecute this action and enforce the Asserted Patents to collect damages for past, present and future infringement thereof. Copies of relevant assignments are attached as Exhibit C and they are incorporated herein by this reference.

24. Koolbridge has complied with the marking requirements of 35 U.S.C. § 287 at least because neither Koolbridge nor any licensee of the Asserted Patents has distributed, sold, or offered for sale any patented product to the public.

SOLAREEDGE'S INFRINGING CONDUCT


25. SolarEdge bills itself as a "global leader in smart energy technology." *See* <https://www.solaredge.com/us/corporate/about-us>. On information and belief, SolarEdge is the biggest supplier of solar inverters to the U.S. residential market.

26. SolarEdge markets and sells solar inverters including one or more single-phase solar inverters with HD-Wave technology ("HD-Wave Inverters"). Further information about the

SolarEdge HD-Wave Inverters is provided at [https://www.solaredge.com/us/products/pv-inverter/single-phase#/,](https://www.solaredge.com/us/products/pv-inverter/single-phase#/) which is incorporated herein by this reference.

27. SolarEdge uses, makes, imports, offers to sell, and/or sells the HD-Wave Inverters in the United States and those activities constitute direct, literal infringement and/or infringement under the doctrine of equivalents, and/or indirect infringement of the Asserted Patents.

28. Specifically, sale in the United States of the HD-Wave Inverters by SolarEdge constitutes infringement of at least Claims 1, 3, and 6 of the '822 Patent. An exemplary claim chart showing how and why the HD-Wave Inverters infringe Claim 1 of the '822 Patent follows:

Claim 1 of the '822 Patent	Evidence of Infringement
[1a] DC to AC conversion apparatus for converting power from a DC source to produce an power output waveform at a first repetition frequency, comprising:	<p>Claim 1 of the '822 Patent is infringed by SolarEdge inverters using HD-Wave technology. Examples of such inverters are shown below.</p>  <p>SolarEdge sells single-phase inverters with HD-Wave technology within the United States, including at least the SE3000H-US, the SE3800H-US, the SE5000H-US, the SE6000H-US, the SE7600H-US, the SE10000H-US, and the SE11400H-US. <i>See Datasheet for Single Phase Inverter with HD-Wave Technology</i> (downloaded from https://www.solaredge.com/us/products/pv-inverter/single-phase#/) (hereinafter the "Datasheet").</p>

Claim 1 of the '822 Patent	Evidence of Infringement
	<p>To the extent that the preamble of this claim is limiting, SolarEdge's inverters with H-D Wave technology meet this limitation.</p> <p>The SolarEdge inverters with HD-Wave technology are configured to convert DC input power to DC output power.</p> <p style="text-align: center;">SolarEdge's Innovative Inverter Topology</p> <p>Because Maximum Power Point Tracking and voltage management are handled separately for each solar module by the SolarEdge power optimizer, the single phase inverter is only responsible for DC to AC inversion. Consequently, it is a simpler, more cost effective, more reliable solar inverter. The fixed string voltage ensures operation at the highest efficiency at all times independent of string length and temperature.</p> <p>In addition to its functionality as a DC-optimized PV inverter, the single phase inverter also manages battery and system energy as part of SolarEdge's StorEdge solution (https://www.solaredge.com/us/StorEdge-solutions).</p> <p>See https://www.solaredge.com/us/products/pv-inverter/single-phase#.</p> <p style="text-align: center;">SolarEdge Inverter</p> <p>The SolarEdge inverter efficiently converts DC power from the modules into AC power that can be fed into the main AC service of the site and from there to the grid. The inverter also receives the monitoring data from each power optimizer and transmits it to a central server (the SolarEdge monitoring platform; requires Internet connection).</p> <p>See Installation Guide for Single Phase Inverter with HD-Wave Technology, Version 1.3, at p. 12 (downloaded from https://www.solaredge.com/us/products/pv-inverter/single-phase#) (hereinafter the "Installation Guide").</p>

Claim 1 of
the '822
Patent

Evidence of Infringement

A 3D perspective view of a SolarEdge inverter. It is a rectangular metal enclosure with a hinged lid. On the front panel, there is a rotary safety switch labeled 'Safety Switch' with 'ON' and 'OFF' positions. To the left of the switch is a 'Drain Valve' with a hose connection. Below the switch is a 'DC input' port with a cable. To the right of the DC input is a 'Communication gland' with a cable. On the far right is an 'AC output' port with a cable. The inverter is shown in a light blue/grey color.

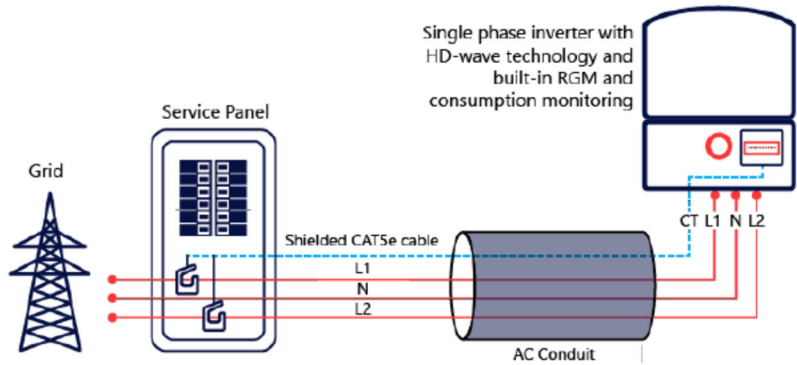

See Installation Guide, p. 27.

MODEL NUMBER	SE3000H-US	SE3800H-US	SE5000H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US						
APPLICABLE TO INVERTERS WITH PART NUMBER	SEXXXXH-XXXXXX4												
OUTPUT													
Rated AC Power Output	3000	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA					
Maximum AC Power Output	3000	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA					
AC Output Voltage Min.-Nom.-Max. (211 - 240 - 264)	✓	✓	✓	✓	✓	✓	✓	Vac					
AC Output Voltage Min.-Nom.-Max. (183 - 208 - 229)	-	✓	-	✓	-	-	✓	Vac					
AC Frequency (Nominal)	59.3 - 60 - 60.5 ⁽¹⁾							Hz					
Maximum Continuous Output Current @240V	12.5	16	21	25	32	42	47.5	A					
Maximum Continuous Output Current @208V	-	16	-	24	-	-	48.5	A					
Power Factor	1, Adjustable - 0.85 to 0.85												
GFDI Threshold	1							A					
Utility Monitoring, Islanding Protection, Country Configurable Thresholds	Yes												
INPUT													
Maximum DC Power @240V	4650	5900	7750	9300	11800	15500	17650	W					
Maximum DC Power @208V	-	5100	-	7750	-	-	15500	W					
Transformer-less, Ungrounded	Yes												
Maximum Input Voltage	480							Vdc					
Nominal DC Input Voltage	380						400	Vdc					
Maximum Input Current @240V ⁽²⁾	8.5	10.5	13.5	16.5	20	27	30.5	Adc					
Maximum Input Current @208V ⁽²⁾	-	9	-	13.5	-	-	27	Adc					
Max. Input Short Circuit Current	45							Adc					
Reverse-Polarity Protection	Yes												
Ground-Fault Isolation Detection	600k Ω Sensitivity												
Maximum Inverter Efficiency	99	99.2						%					
CEC Weighted Efficiency	99						99 @ 240V 98.5 @ 208V	%					
Nighttime Power Consumption	< 2.5							W					

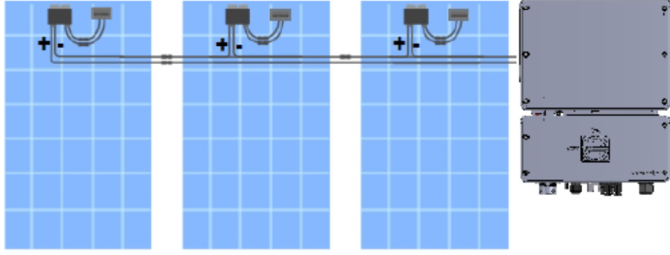
⁽¹⁾ For other regional settings please contact SolarEdge support
⁽²⁾ A higher current source may be used; the inverter will limit its input current to the values stated

See Datasheet, p. 2.

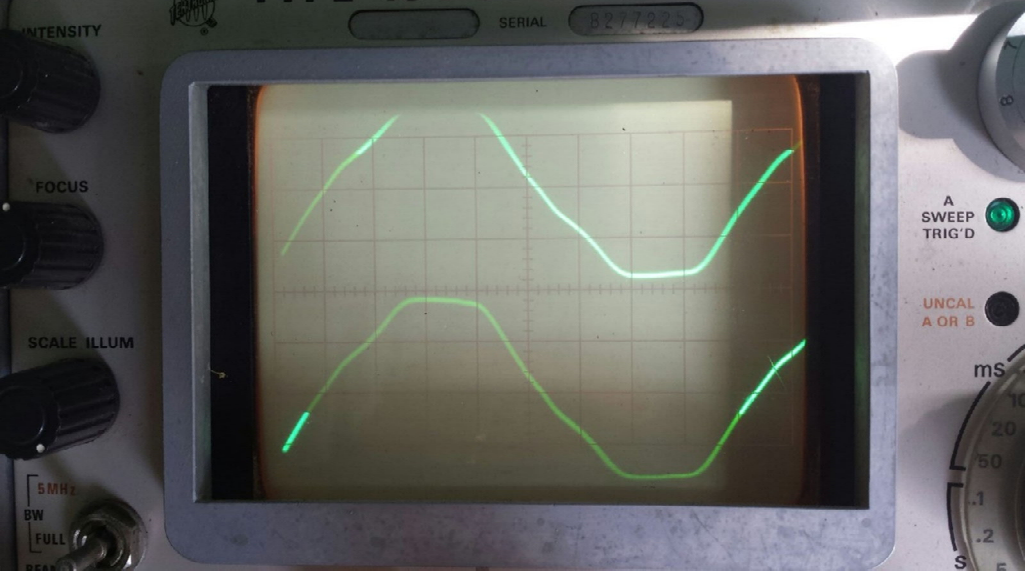
The SolarEdge inverters are designed to provide a power output in the form of a sine wave (*i.e.*, a waveform at a first repetition frequency).

Claim 1 of the '822 Patent	Evidence of Infringement
	<h2 style="text-align: center;">HD-Wave Technology: A New Era for PV Inverters</h2> <p style="text-align: center;">SolarEdge's latest generation of single phase inverters are designed using a novel power conversion technology that is based on a distributed switching and powerful DSP processing. The inverter is able to synthesize a clean sine wave that leads to a dramatic reduction in the magnetics and heavy cooling elements. The result is an even smaller and lighter inverter for simplified shipping and storing, and easy one-person installation. The record-breaking 99% efficiency allows more energy production for an improved ROI.</p> <p>See https://www.solaredge.com/us/products/pv-inverter/single-phase#/.</p> <p>Additional information about the SolarEdge inverters is described in connection with elements [1b] through [1g] below.</p>
<p>[1b] a set of at least one live AC output terminals, at least one output terminal designated as a ground, neutral, or reference potential terminal;</p>	<p>SolarEdge single-phase inverters with HD-Wave technology include a set of AC output terminals.</p>  <p>See Datasheet, p. 3.</p> <h3 style="color: red;">Grid Connection Guidelines</h3> <ul style="list-style-type: none"> ■ In single phase inverters connected to corner grounded grids, connect the L2 terminal to the grounded conductor. When connecting to other grids, L1 and L2 are interchangeable. <p>See Installation Manual, p. 37.</p> <ol style="list-style-type: none"> 3. Connect the wires to the appropriate terminal blocks according to the labels on the terminal blocks (N, , L1 and L2).

Claim 1 of the '822 Patent	Evidence of Infringement
	<p><i>See Installation Manual, p. 37.</i></p> <p>At least one of the AC output terminals is designated as a ground, neutral, or reference potential terminal which is configured to be connected to a grounded conductor.</p> <p>Grid Connection Guidelines</p> <p>■ In single phase inverters connected to corner grounded grids, connect the L2 terminal to the grounded conductor. When connecting to other grids, L1 and L2 are interchangeable.</p> <p><i>See Installation Manual, p. 37.</i></p>
<p>[1c] a floating DC power source having a positive and a negative terminal connected respectively to the positive and negative DC input terminals of a DC to AC converter,</p>	<p>The SolarEdge inverters are configured for use with SolarEdge's power optimizers.</p> <p><i>Specifically designed to work with SolarEdge power optimizers</i></p> <p><i>See https://www.solaredge.com/us/products/pv-inverter/single-phase#.</i></p> <p>Each power optimizer provides DC power. For example, when the optimizers are coupled to a solar panel, each optimizer provides 1 volt of power.</p> <p>When a module is connected to a power optimizer, the power optimizer outputs a safe voltage of 1V ($\pm 0.1V$). Therefore, the total string voltage should equal 1V times the number of power optimizers connected in series in the string. For example, if 10 power optimizers are connected in a string, then 10V should be produced.</p> <p><i>See Installation Guide, p. 24.</i></p> <p>The SolarEdge inverters with HD-Wave technology are configured to be connected to the power optimizers in series and not connected to the grounded conductor (<i>i.e.</i>, the power optimizers are floating).</p>


Claim 1 of the '822 Patent	Evidence of Infringement
	 <p data-bbox="662 604 1175 632">Figure 9: Power optimizers connected in series</p> <p data-bbox="402 674 776 709"><i>See Installation Guide, p. 24.</i></p> <p data-bbox="444 741 1373 926">The inverter input and output circuits are isolated from the enclosure. This system does not include an isolation transformer and should be installed with an ungrounded PV array in accordance with the requirements of NEC Articles 690.35 and 690.43 National Electric Code, ANSI/NFPA 70, 2011 (and Canadian Electrical Code, Part I, for installations in Canada).</p> <p data-bbox="402 968 760 1003"><i>See Installation Guide, p. 8.</i></p> <p data-bbox="402 1045 1422 1262">In addition, the SolarEdge single-phase inverters with HD-Wave technology are specifically designed for use with photovoltaic power sources (such as the SolarEdge optimizers and/or solar panels), and SolarEdge provides instructions on how to install the inverters into configurations using such floating power sources. <i>See generally</i> Installation Guide. In addition, SolarEdge has been on notice of the '822 Patent since at least early 2018.</p>
[1d] Wherein the DC to AC converter causes:	<i>See elements [1e] through [1g] below.</i>
[1e] (1) an AC output waveform at said first repetition frequency and having a voltage relative to one of said at	The SolarEdge inverters are configured to provide a power output in the form of a sine wave (<i>i.e.</i> , a waveform at a first repetition frequency).

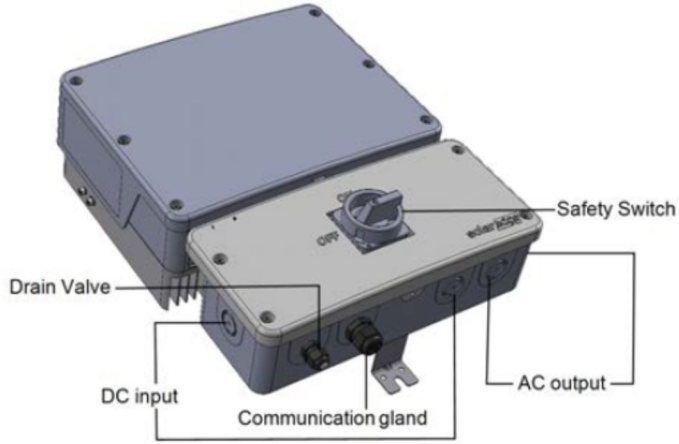
Claim 1 of the '822 Patent	Evidence of Infringement
<p>least one ground, neutral or reference potential terminals to appear with a unique phase at each of a number N at least equal to one of said live AC output terminals, and</p>	<p style="text-align: center;">HD-Wave Technology: A New Era for PV Inverters</p> <p style="text-align: center;"><small>SolarEdge's latest generation of single phase inverters are designed using a novel power conversion technology that is based on a distributed switching and powerful DSP processing. The inverter is able to synthesize a clean sine wave that leads to a dramatic reduction in the magnetics and heavy cooling elements. The result is an even smaller and lighter inverter for simplified shipping and storing, and easy one-person installation. The record-breaking 99% efficiency allows more energy production for an improved ROI.</small></p> <p><i>See https://www.solaredge.com/us/products/pv-inverter/single-phase#/>.</i></p> <p>Koolbridge obtained a SolarEdge HD-Wave DC to AC inverter, model SE5000H, for testing. Koolbridge also obtained several SolarEdge optimizers, model P405. Six P405 optimizers, each connected to a solar panel, were connected in series between the solar array and the inverter. The L2 output was connected to the grounded conductor as per the Installation Guide. Measurements from an oscilloscope confirmed a voltage of 240 volts RMS on the L1 output relative to L2. The measurements also confirmed that the output wave has a frequency of 60 Hz.</p> <p>The SolarEdge inverters are configured to provide a waveform with a unique phase at N=1 terminals as discussed above. The claims encompass N=1. <i>See</i> Claim 1("a number N at least equal to one"); Claim 3 ("said number N is equal to 1, 2, or 3.").</p>
<p>[1f] (2) a common-mode voltage waveform at a second repetition frequency to appear relative to one of said at least one ground, neutral or reference potential terminals and in the</p>	<p>The SolarEdge inverters are configured to provide a common-mode voltage waveform.</p> <p>As discussed above, Koolbridge obtained a SolarEdge HD-Wave DC to AC inverter, model SE5000H, for testing. Koolbridge also obtained several SolarEdge optimizers, model P405. Six P405 optimizers, each connected to a solar panel, were connected in series between the solar array and the inverter. The L2 output was connected to the grounded conductor as per the Installation Guide.</p> <p>Measurements from the oscilloscope showed waveforms having a frequency of 60 Hz and having the same phase on both the positive and negative input terminals of the DC power source. The oscilloscope trace is shown below.</p>

Claim 1 of the '822 Patent	Evidence of Infringement
same phase on both said positive and negative terminals of said DC power source,	
[1g] wherein the second frequency is a multiple equal to the same said number N of said first repetition frequency.	The second frequency (60 Hz) is a multiple equal to the same said number N (N=1) of said first repetition frequency (60 Hz).

29. Similarly, sale by SolarEdge in the United States of the HD-Wave Inverters also infringe at least Claims 1, 2, 3, and 6 of the '710 Patent, with an exemplary claim chart showing the basis for infringement of Claim 1 of the '710 Patent following:

Claim 1 of the '710 Patent	Evidence of Infringement
[1a] A DC to AC converter having a transformerless output, and operative to convert DC	Claim 1 of the '710 Patent is infringed by SolarEdge inverters using HD-Wave technology. Examples of such inverters are shown below.

Claim 1 of the '710 Patent	Evidence of Infringement
<p>power to an AC power having a desirable voltage and waveform,</p>	<div data-bbox="500 300 1344 898">  </div> <p>SolarEdge sells single-phase inverters with HD-Wave technology within the United States, including at least the SE3000H-US, the SE3800H-US, the SE5000H-US, the SE6000H-US, the SE7600H-US, the SE10000H-US, and the SE11400H-US. <i>See</i> Datasheet for Single Phase Inverter with HD-Wave Technology (downloaded from https://www.solaredge.com/us/products/pv-inverter/single-phase#/) (hereinafter the "Datasheet").</p> <p>To the extent that the preamble of this claim is limiting, SolarEdge's inverters with H-D Wave technology meet this limitation.</p> <p>The SolarEdge inverters with HD-Wave technology are configured to convert DC input power to AC output power.</p> <div data-bbox="581 1409 1218 1514"> <h2>SolarEdge's Innovative Inverter Topology</h2> </div> <div data-bbox="581 1539 1266 1617"> <p>Because Maximum Power Point Tracking and voltage management are handled separately for each solar module by the SolarEdge power optimizer, the single phase inverter is only responsible for DC to AC inversion. Consequently, it is a simpler, more cost</p> </div> <div data-bbox="581 1663 1235 1711"> <p>effective, more reliable solar inverter. The fixed string voltage ensures operation at the highest efficiency at all times independent of string length and temperature.</p> </div> <div data-bbox="581 1738 1266 1816"> <p>In addition to its functionality as a DC-optimized PV inverter, the single phase inverter also manages battery and system energy as part of SolarEdge's StorEdge solution (https://www.solaredge.com/us/StorEdge-solutions).</p> </div> <p><i>See</i> https://www.solaredge.com/us/products/pv-inverter/single-phase#/.</p>

Claim 1 of the '710 Patent	Evidence of Infringement
	<p>SolarEdge Inverter</p> <p>The SolarEdge inverter efficiently converts DC power from the modules into AC power that can be fed into the main AC service of the site and from there to the grid. The inverter also receives the monitoring data from each power optimizer and transmits it to a central server (the SolarEdge monitoring platform; requires Internet connection).</p> <p>See Installation Guide for Single Phase Inverter with HD-Wave Technology, Version 1.3, at p. 12 (downloaded from https://www.solaredge.com/us/products/pv-inverter/single-phase#/) (hereinafter the "Installation Guide").</p>  <p>See Installation Guide, p. 27.</p>

Claim 1 of the '710 Patent

Evidence of Infringement

MODEL NUMBER	SE3000H-US	SE3800H-US	SE5000H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US	
APPLICABLE TO INVERTERS WITH PART NUMBER	SEXXXXH-XXXXXBXX4							
OUTPUT								
Rated AC Power Output	3000	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA
Maximum AC Power Output	3000	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA
AC Output Voltage Min.-Nom.-Max. (211 - 240 - 264)	✓	✓	✓	✓	✓	✓	✓	Vac
AC Output Voltage Min.-Nom.-Max. (183 - 208 - 229)	-	✓	-	✓	-	-	✓	Vac
AC Frequency (Nominal)	59.3 - 60 - 60.5 ¹⁾							Hz
Maximum Continuous Output Current @240V	12.5	16	21	25	32	42	47.5	A
Maximum Continuous Output Current @208V	-	16	-	24	-	-	48.5	A
Power Factor	1, Adjustable - 0.85 to 0.85							
GFDI Threshold	1							A
Utility Monitoring, Islanding Protection, Country Configurable Thresholds	Yes							
INPUT								
Maximum DC Power @240V	4650	5900	7750	9300	11800	15500	17650	W
Maximum DC Power @208V	-	5100	-	7750	-	-	15500	W
Transformer-less, Ungrounded	Yes							
Maximum Input Voltage	480							Vdc
Nominal DC Input Voltage	380			400				Vdc
Maximum Input Current @240V ²⁾	8.5	10.5	13.5	16.5	20	27	30.5	Adc
Maximum Input Current @208V ²⁾	-	9	-	13.5	-	-	27	Adc
Max. Input Short Circuit Current	45							Adc
Reverse-Polarity Protection	Yes							
Ground-Fault Isolation Detection	600kA Sensitivity							
Maximum Inverter Efficiency	99	99.2						%
CEC Weighted Efficiency	99					99 @ 240V 98.5 @ 208V		%
Nighttime Power Consumption	< 2.5							W
¹⁾ For other regional settings please contact SolarEdge support.								
²⁾ A higher current source may be used, the inverter will limit its input current to the values stated								

See Datasheet, p. 2.

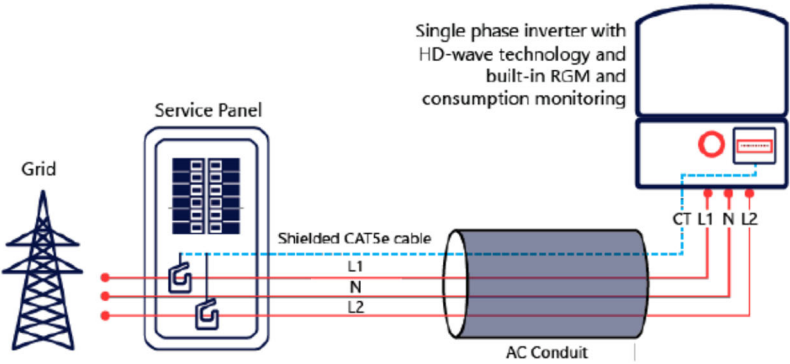
The SolarEdge inverters provide a power output in the form of a sine wave (*i.e.*, an output in a desirable voltage and waveform).



HD-Wave Technology: A New Era for PV Inverters

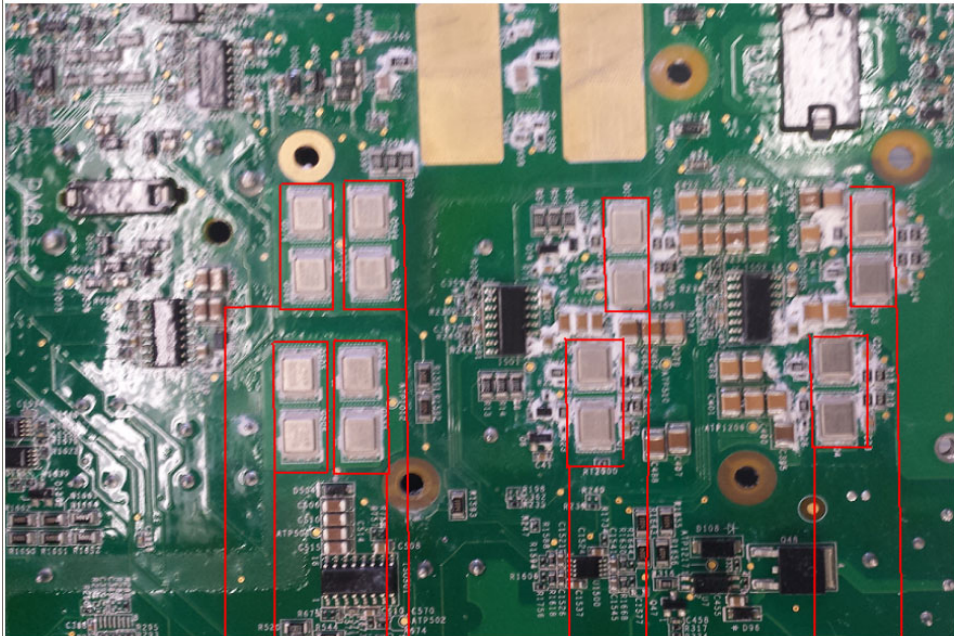
SolarEdge's latest generation of single phase inverters are designed using a novel power conversion technology that is based on a distributed switching and powerful DSP processing. The inverter is able to synthesize a clean sine wave that leads to a dramatic reduction in the magnetics and heavy cooling elements. The result is an even smaller and lighter inverter for simplified shipping and storing, and easy one-person installation. The record-breaking 99% efficiency allows more energy production for an improved ROI.

See <https://www.solaredge.com/us/products/pv-inverter/single-phase#/>.

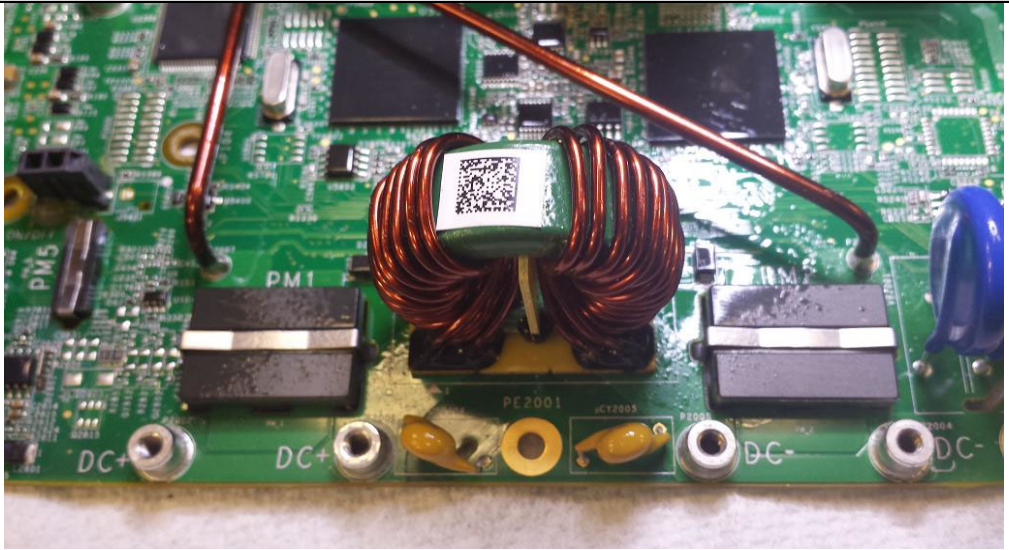
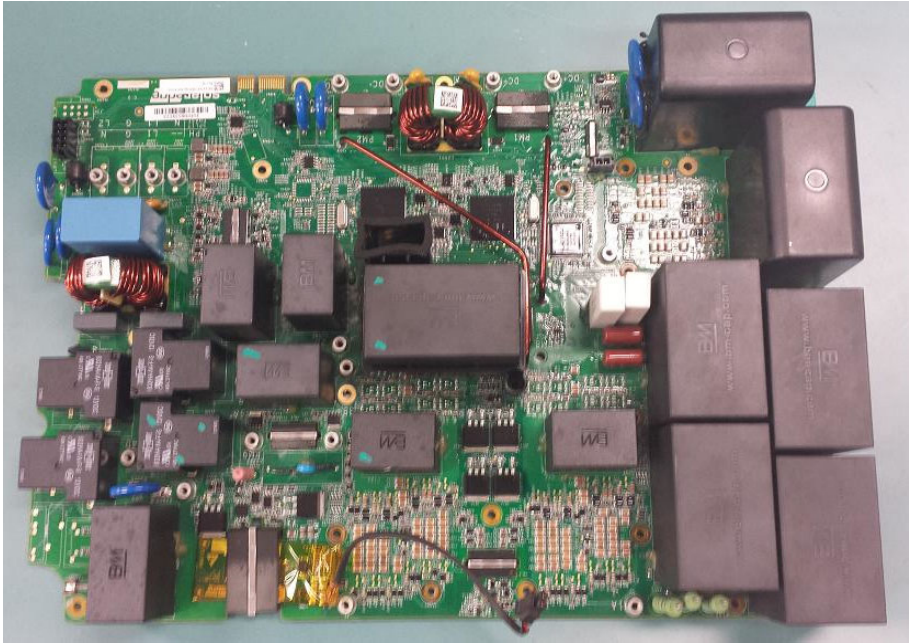
The SolarEdge inverters with HD-Wave technology are transformerless.

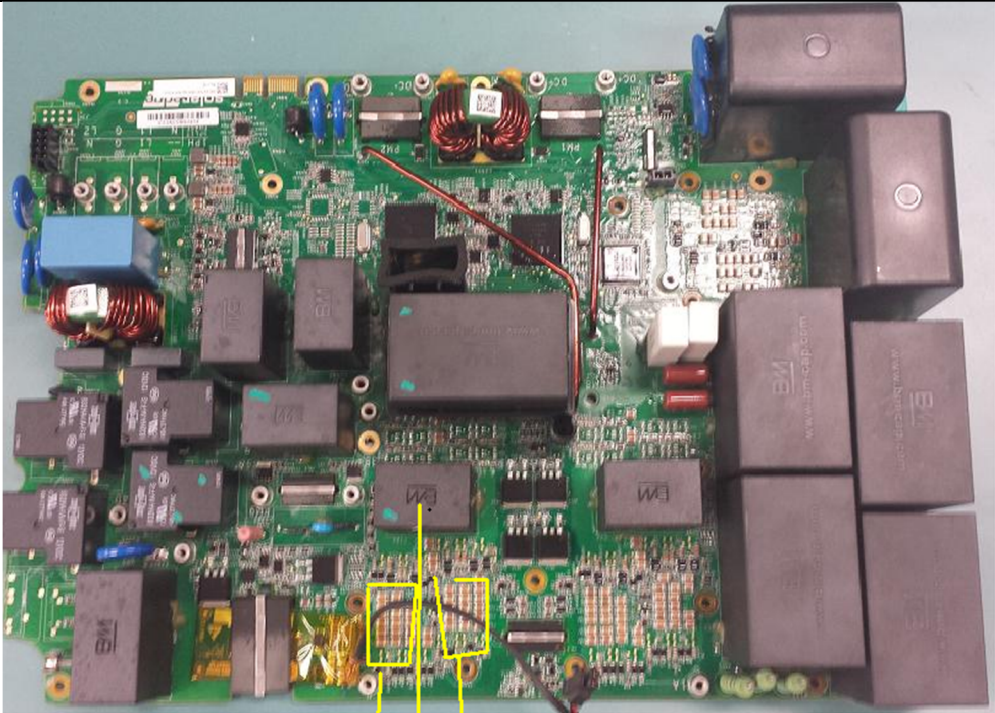
Claim 1 of the '710 Patent	Evidence of Infringement
	<p>NOTE</p> <p>Functional Electrical Earthing of DC-side negative or positive is prohibited because the inverter has no transformer. Equipment grounding of exposed conductive surfaces in the array is required per the NEC.</p> <p>See Installation Guide, p. 38.</p>
<p>[1b] and to output the AC power between hot and neutral output terminals,</p>	<p>To the extent that the preamble of this claim is limiting, SolarEdge's inverters with H-D Wave technology meet this limitation.</p> <p>SolarEdge's HD-Wave inverters output AC power.</p> <p>SolarEdge Inverter</p> <p>The SolarEdge inverter efficiently converts DC power from the modules into AC power that can be fed into the main AC service of the site and from there to the grid. The inverter also receives the monitoring data from each power optimizer and transmits it to a central server (the SolarEdge monitoring platform; requires Internet connection).</p> <p>See Installation Guide, at p. 12.</p> <p>Power is output between a hot terminal and a neutral terminal.</p>  <p>See Datasheet, p. 3.</p> <p>Grid Connection Guidelines</p> <p>■ In single phase inverters connected to corner grounded grids, connect the L2 terminal to the grounded conductor. When connecting to other grids, L1 and L2 are interchangeable.</p> <p>See Installation Manual, p. 37.</p>

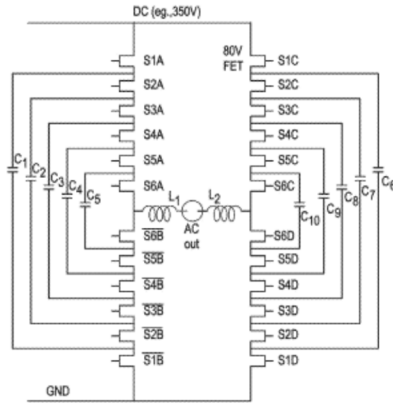
Claim 1 of the '710 Patent	Evidence of Infringement
	<p>3. Connect the wires to the appropriate terminal blocks according to the labels on the terminal blocks (N, , L1 and L2).</p> <p><i>See Installation Manual, p. 37.</i></p> <p>Grid Connection Guidelines</p> <p> In single phase inverters connected to corner grounded grids, connect the L2 terminal to the grounded conductor. When connecting to other grids, L1 and L2 are interchangeable.</p> <p><i>See Installation Manual, p. 37.</i></p>
[1c] the DC to AC converter comprising:	<i>See elements [1d] through [1g] below.</i>
[1d] a plurality of controlled switches,	<p>SolarEdge's inverters with HD-Wave technology include a plurality of switches.</p> <p>A SolarEdge HD-Wave DC to AC inverter, model SE5000H was subjected to a teardown. As shown in the image below, the SolarEdge inverter includes several switches that each include two MOSFETs (Metal-Oxide-Semiconductor Field-Effect Transistors) (Tr1 through Tr8). In particular, the switch appears to include two Infineon MOSFETs that are connected in parallel.</p>

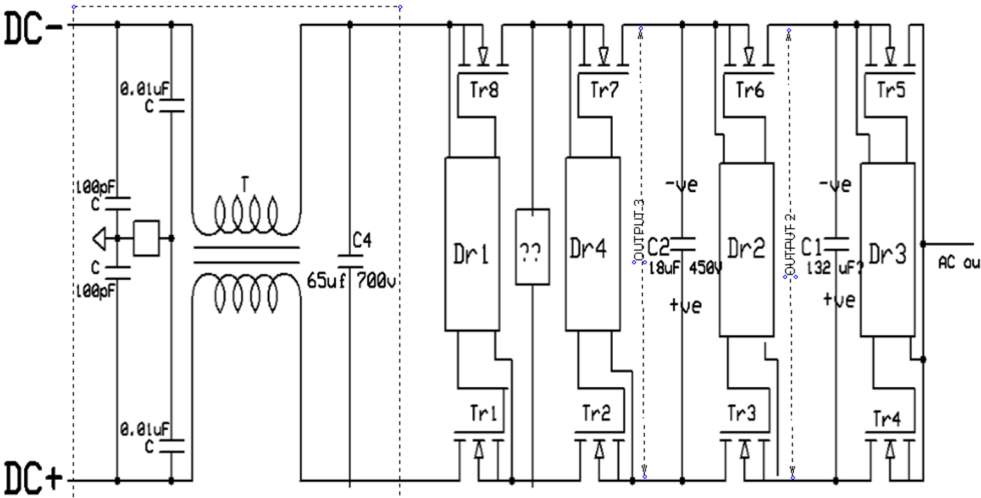
Claim 1 of the '710 Patent	Evidence of Infringement																																																																									
	<div><p>Tr8 Tr1 Tr2 Tr7 Tr3 Tr6 Tr4 Tr5</p></div> <p>The switches are controlled by MOSFET drivers (in particular, Silicon Labs MOSFET drivers type Si8238AB). Each MOSFET driver has two logic input controls.</p> <div><div><p>SOIC-16 (Wide)</p><table><tr><td>VIA</td><td>1</td><td>16</td><td>VDDA</td></tr><tr><td>VIB</td><td>2</td><td>15</td><td>VOA</td></tr><tr><td>VDDI</td><td>3</td><td>14</td><td>GNDA</td></tr><tr><td>GNDI</td><td>4</td><td>13</td><td>NC</td></tr><tr><td>DISABLE</td><td>5</td><td>12</td><td>NC</td></tr><tr><td>NC</td><td>6</td><td>11</td><td>VDDB</td></tr><tr><td>NC</td><td>7</td><td>10</td><td>VOB</td></tr><tr><td>VDDI</td><td>8</td><td>9</td><td>GNDB</td></tr></table></div><div><p>SOIC-16 (Narrow)</p><table><tr><td>VIA</td><td>1</td><td>16</td><td>VDDA</td></tr><tr><td>VIB</td><td>2</td><td>15</td><td>VOA</td></tr><tr><td>VDDI</td><td>3</td><td>14</td><td>GNDA</td></tr><tr><td>GNDI</td><td>4</td><td>13</td><td>NC</td></tr><tr><td>DISABLE</td><td>5</td><td>12</td><td>NC</td></tr><tr><td>NC</td><td>6</td><td>11</td><td>VDDB</td></tr><tr><td>NC</td><td>7</td><td>10</td><td>VOB</td></tr><tr><td>VDDI</td><td>8</td><td>9</td><td>GNDB</td></tr></table></div></div> <p>Table 5.3. Si8232/5/7/8 Dual Isolated Driver (SOIC-16). WB SOIC-14 with IS3 package designation, has pins 12 & 13 missing</p> <table><tr><th>Pin</th><th>Name</th><th>Description</th></tr><tr><td>1</td><td>VIA</td><td>Non-inverting logic input terminal for Driver A.</td></tr><tr><td>2</td><td>VIB</td><td>Non-inverting logic input terminal for Driver B.</td></tr></table> <p>Si823x Data Sheet, Rev. 2.15, at p. 37 (downloaded from https://www.silabs.com/documents/public/data-sheets/Si823x.pdf) (hereinafter the "Driver Data Sheet").</p> <p>This is consistent with SolarEdge's patent disclosures. SolarEdge claims inverters it sells that have HD-Wave technology are covered by U.S. Patent No. 9,318,974 ("the '974 Patent").</p>	VIA	1	16	VDDA	VIB	2	15	VOA	VDDI	3	14	GNDA	GNDI	4	13	NC	DISABLE	5	12	NC	NC	6	11	VDDB	NC	7	10	VOB	VDDI	8	9	GNDB	VIA	1	16	VDDA	VIB	2	15	VOA	VDDI	3	14	GNDA	GNDI	4	13	NC	DISABLE	5	12	NC	NC	6	11	VDDB	NC	7	10	VOB	VDDI	8	9	GNDB	Pin	Name	Description	1	VIA	Non-inverting logic input terminal for Driver A.	2	VIB	Non-inverting logic input terminal for Driver B.
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Claim 1 of the '710 Patent	Evidence of Infringement				
	<table><tr><td>SolarEdge HD-Wave Single Phase Inverters</td><td>SExxxxH-xx</td><td>9088178, 9130401, ZL 200780045351.2, 8618692, 9368964, 8710699, 9276410, 8473250, 8903681, CN101636847, EP2089913, GB2480717, 9112379, 8599588, 8102144, 8669675, ZL 200880119506.7, 8531055, 8816535, GB2480015, EP2374190, 8289742, 9590526, 9438035</td><td>8384243, 8659188, ZL200880132210.9, 9318974</td></tr></table> <p>See SolarEdge Patent Notice (downloaded from https://www.solaredge.com/sites/default/files/se_patents.pdf). Independent claim 1 of the '974 Patent recites two sets of switches, i.e., a plurality of switches.</p> <p>We claim:</p> <p>1. An apparatus comprising:</p> <ul style="list-style-type: none">a multi-level inverter comprising a first phase circuit and a second phase circuit, each of the first and the second phase circuits comprising a flying capacitor circuit;a first set of switches connecting the first phase circuit between voltage input terminals and a second set of switches connecting the second phase circuit between the voltage input terminals; andan interphase balancing circuit comprising a first pair of terminals connected in parallel across the first phase circuit and a second pair of terminals connected in parallel across the second phase circuit. <p>The only other independent claim likewise recites a first pair of switches and a second pair of switches, such that the SolarEdge HD-Wave inverters must have a plurality of switches if they are covered by the '974 Patent.</p>	SolarEdge HD-Wave Single Phase Inverters	SExxxxH-xx	9088178, 9130401, ZL 200780045351.2, 8618692, 9368964, 8710699, 9276410, 8473250, 8903681, CN101636847, EP2089913, GB2480717, 9112379, 8599588, 8102144, 8669675, ZL 200880119506.7, 8531055, 8816535, GB2480015, EP2374190, 8289742, 9590526, 9438035	8384243, 8659188, ZL200880132210.9, 9318974
SolarEdge HD-Wave Single Phase Inverters	SExxxxH-xx	9088178, 9130401, ZL 200780045351.2, 8618692, 9368964, 8710699, 9276410, 8473250, 8903681, CN101636847, EP2089913, GB2480717, 9112379, 8599588, 8102144, 8669675, ZL 200880119506.7, 8531055, 8816535, GB2480015, EP2374190, 8289742, 9590526, 9438035	8384243, 8659188, ZL200880132210.9, 9318974		
[1e] each having a power input connection operative to accept DC power from an associated DC power source at an associated DC voltage,	The SolarEdge inverters with HD-Wave technology have a DC power input as shown in the image below.				

Claim 1 of the '710 Patent	Evidence of Infringement
	 <p data-bbox="423 884 1425 1066">Each switch (as discussed above in connection with element [1d]) likewise includes a power input connection. In operation, every MOSFET has a power input and thus a power input connection. The power input connection for each switch is connected to a capacitor. The image below shows the capacitors in the SolarEdge HD-Wave DC to AC inverter, model SE5000H.</p>  <p data-bbox="423 1776 1425 1850">The capacitors include the black boxes labeled with the letters BM or labeled with a ring shape.</p>

Claim 1 of the '710 Patent	Evidence of Infringement
	 <p data-bbox="656 1014 1016 1050">(Partial) C1 C2 C1 (Partial)</p> <p data-bbox="425 1087 1414 1304">The capacitors also include surface mounted capacitors such as the capacitors that form C1 as indicated above. Different capacitors shown in this image have varying capacitances. The capacitor (or combinations of capacitors) provides a DC voltage to the power input connection of the switch. The DC power provided by the capacitors (i.e., the associated DC voltage) will vary based on the capacitance of the capacitor.</p> <p data-bbox="425 1346 1414 1598">Again, this is consistent with SolarEdge's patent disclosure. The switches recited in Claim 1 of the '974 Patent (as discussed above in connection with element [1d]) connect phase circuits "between voltage input terminals" and therefore connect either directly or indirectly to the DC power source. Although the claims of the '974 Patent do not discuss these details, the disclosure of the '974 Patent further supports the switches having power input connections operative to accept DC power.</p>

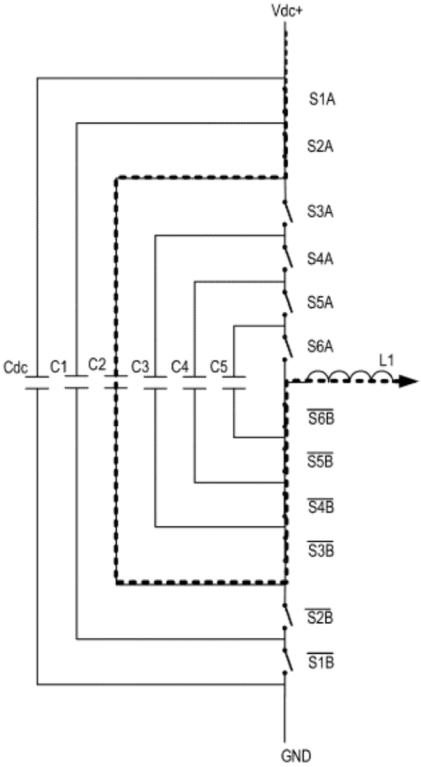
Claim 1 of the '710 Patent	Evidence of Infringement
	<p style="text-align: center;">FIG. 1A</p>  <p>Figure 1A (showing an exemplary multi-level inverter including parallel connections of a plurality of switches disposed across a DC voltage, as described at 4:36-39). Each of the switches may have a different associated DC voltage depending on the associated capacitor.</p> <p style="text-align: center;">FIG. 1B illustrates half of the circuit illustrated in FIG. 1A. In various embodiments, during steady-state operation the capacitor voltages (C1, C2, C3, C4, and C5) average at $5/6 \cdot V_{dc}$, $4/6 \cdot V_{dc}$, $3/6 \cdot V_{dc}$, $2/6 \cdot V_{dc}$, $1/6 \cdot V_{dc}$ respectively (e.g. multiples of $1/N$, where N is the number capacitors or the number switches in a bank, assuming the capacitors are of equal value). For embodiments where the capacitors are not of the same value, steady-state average voltage across each capacitor will scale accordingly.</p> <p><i>See '974 Patent at 4:48-56.</i></p>
[1f] and each controlled switch further having a power output connection operative to output a selected one of: (a) the associated DC voltage, (b) the associated DC voltage	Based on a circuit trace of the SolarEdge inverter, model SE5000H, the circuit of the SolarEdge inverter can be depicted as follows:

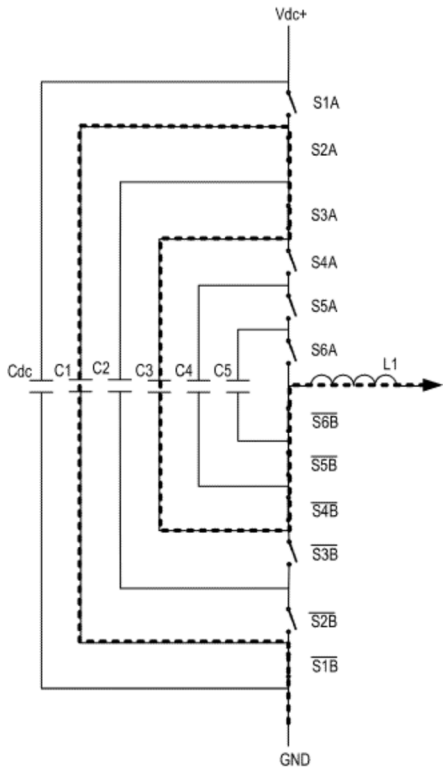
Claim 1 of the '710 Patent	Evidence of Infringement																									
having an inverted polarity, and (c) zero voltage, in response to an associated ternary-valued selection signal representing the multiplier values +1, -1, or 0 respectively,	<div><p>Common mode filter</p></div> <p>As shown in this image, each switch (for example, the switch including Tr6 and Tr3) has a power output connection (denoted Output 2 in the figure). The switch will output (1) the associated DC voltage (i.e., the DC voltage associated with capacitor C2), (2) the associated DC voltage having an inverted polarity, or (3) zero voltage depending on the inputs to the drivers in the circuit. For example, the selection signal (VIB_{DR4}, VIB_{DR2})¹ will result in the following contributions from capacitor C2 based on the switch including Tr3 and Tr6:</p> <table><tr><th>VIB_{DR4}</th><th>VIB_{DR2}</th><th>TR2 state</th><th>TR3 state</th><th>C2 contribution</th></tr><tr><td>0</td><td>1</td><td>OFF</td><td>ON</td><td>+V2</td></tr><tr><td>1</td><td>0</td><td>ON</td><td>OFF</td><td>-V2</td></tr><tr><td>0</td><td>0</td><td>OFF</td><td>OFF</td><td>0</td></tr><tr><td>1</td><td>1</td><td>ON</td><td>ON</td><td>0</td></tr></table> <p>The signal (0,1) corresponds to the multiplier value +1, the signal (1,0) corresponds to the multiplier value -1, and the signals (0,0) and (1,1) correspond to the multiplier value 0. Because the binary pairs (0,0) and (1,1) result in the same zero voltage contribution, this is a ternary-valued selection signal. See dependent claim 6.</p>	VIB_{DR4}	VIB_{DR2}	TR2 state	TR3 state	C2 contribution	0	1	OFF	ON	+V2	1	0	ON	OFF	-V2	0	0	OFF	OFF	0	1	1	ON	ON	0
VIB_{DR4}	VIB_{DR2}	TR2 state	TR3 state	C2 contribution																						
0	1	OFF	ON	+V2																						
1	0	ON	OFF	-V2																						
0	0	OFF	OFF	0																						
1	1	ON	ON	0																						

¹ VIB_{DRX} refers to the VIB input signal for Driver X (corresponding to the input at pin 2 of Driver X).

Claim 1 of the '710 Patent	Evidence of Infringement									
	<div><div><div><div><div>SOIC-16 (Wide)</div><div><div><div>VIA</div><div>1</div></div><div><div>VIB</div><div>2</div></div><div><div>VDDI</div><div>3</div></div><div><div>GNDI</div><div>4</div></div><div><div>DISABLE</div><div>5</div></div><div><div>NC</div><div>6</div></div><div><div>NC</div><div>7</div></div><div><div>VDDI</div><div>8</div></div></div><div><div>Si8232</div><div>Si8235</div><div>Si8237</div><div>Si8238</div></div><div><div>16</div><div>VDDA</div></div><div><div>15</div><div>VOA</div></div><div><div>14</div><div>GNDA</div></div><div><div>13</div><div>NC</div></div><div><div>12</div><div>NC</div></div><div><div>11</div><div>VDDB</div></div><div><div>10</div><div>VOB</div></div><div><div>9</div><div>GNDB</div></div></div></div><div><div>SOIC-16 (Narrow)</div><div><div><div>VIA</div><div>1</div></div><div><div>VIB</div><div>2</div></div><div><div>VDDI</div><div>3</div></div><div><div>GNDI</div><div>4</div></div><div><div>DISABLE</div><div>5</div></div><div><div>NC</div><div>6</div></div><div><div>NC</div><div>7</div></div><div><div>VDDI</div><div>8</div></div></div><div><div>Si8232</div><div>Si8235</div><div>Si8237</div><div>Si8238</div></div><div><div>16</div><div>VDDA</div></div><div><div>15</div><div>VOA</div></div><div><div>14</div><div>GNDA</div></div><div><div>13</div><div>NC</div></div><div><div>12</div><div>NC</div></div><div><div>11</div><div>VDDB</div></div><div><div>10</div><div>VOB</div></div><div><div>9</div><div>GNDB</div></div></div></div></div> <div>Table 5.3. Si8232/5/7/8 Dual Isolated Driver (SOIC-16). WB SOIC-14 with IS3 package designation, has pins 12 & 13 missing</div> <table><tr><th>Pin</th><th>Name</th><th>Description</th></tr><tr><td>1</td><td>VIA</td><td>Non-inverting logic input terminal for Driver A.</td></tr><tr><td>2</td><td>VIB</td><td>Non-inverting logic input terminal for Driver B.</td></tr></table> <p>See Driver Data Sheet, at p. 37.</p> <p>Once again, this is consistent with SolarEdge's patent disclosure. According to the specification of the '974 Patent, each switch consists of a number of MOSFET transistors. The switch is configured so as to either add the associated DC voltage to the output voltage, subtract the associated DC voltage from the output voltage, or to contribute zero voltage to the DC voltage, as discussed throughout the '974 Patent. Indeed, the circuit shown above appears to be operationally very similar to if not the same as the circuits shown and described in the '974 Patent.</p> <p>When there is no overlap of the control signals, only one out of six MOSFET is ON (i.e., closed) on the high-side while only one out of six MOSFETS is OFF (i.e., open) on the low side as shown in FIG. 1E. FIG. 1E is illustrated with the MOSFETS represented as switches, with switch states corresponding to signal S1 On in FIG. 2B. As shown by the dotted line, the current flow is from Vdc+ towards the output (Grid phase #1) while passing through the MOSFETs that are ON and passing through capacitor C1, resulting in C1 charging with some ripple current. Since C1 is charged with 5/6*Vdc the total output voltage in this case, the output voltage is Vdc-5/6*Vdc=1/6*Vdc. When S1 goes off in FIG. 2B, S1=S2=S3=S4=S5=S6=0 which yields an output voltage of 0. Subsequently S2 will be on resulting in an output being the voltage difference between C1 and C2 (5/6*Vdc-4/6*Vdc=1/6*Vdc). The pattern continues with 1/6*Vdc at the output occurring when each switch is turned on. Therefore, during the multiplexing between the on state of one switch and the off states, any voltage between 0 to 1/6*Vdc can be generated with PWM. This occurs for any case where the duty cycles are below 1/6, resulting in no overlap in ON signals between the MOSFETs.</p>	Pin	Name	Description	1	VIA	Non-inverting logic input terminal for Driver A.	2	VIB	Non-inverting logic input terminal for Driver B.
Pin	Name	Description								
1	VIA	Non-inverting logic input terminal for Driver A.								
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Claim 1 of the '710 Patent	Evidence of Infringement
	<p data-bbox="423 310 764 342"><i>See '974 Patent at 6:14-35.</i></p> <div data-bbox="651 394 1170 1157"> </div> <p data-bbox="899 1213 1016 1245" style="text-align: center;">FIG. 1E</p> <p data-bbox="602 1287 1235 1577">As another example, FIG. 1F shows the switch states and current flow when there is an overlap between S1 and S2 (due to a duty cycle between 1/6 and 2/6 in this specific example). The dotted line again shows the path from Vdc towards the output, and in this case capacitor C2 is used. C2 is charged to a voltage of $4/6 \cdot V_{dc}$, and therefore the output is $V_{dc} - 4/6 \cdot V_{dc} = 2/6 \cdot V_{dc}$. In this specific case the PWM multiplexing will be between $1/6 \cdot V_{dc}$ (as in the previous case of a single MOSFET in the ON state) and $2/6 \cdot V_{dc}$, corresponding to a duty cycle that is between 1/6 and 2/6.</p> <p data-bbox="423 1612 764 1644"><i>See '974 Patent at 6:40-49.</i></p>

Claim 1 of the '710 Patent	Evidence of Infringement
	 <p data-bbox="906 1140 1023 1176">FIG. 1F</p> <p data-bbox="592 1234 1253 1596">Another example of a duty cycle between 1/6 and 2/6 is shown in FIG. 1G where two capacitors are used in the same path towards the output. This is a case of overlap between S2 and S3, again for duty cycles between 1/6 and 2/6. The path goes through capacitor C1 ($V_{dc} \cdot 5/6$) and capacitor C3 ($V_{dc} \cdot 3/6$) but in different directions, such that the output voltage is $V_{dc} \cdot 5/6 - V_{dc} \cdot 3/6 = V_{dc} \cdot 2/6$, which is the same as the previous case. Now, however, capacitor C3 gets charged with ripple current and capacitor C1 gets discharged with ripple current. It is noted that capacitor C1 was charged in the previous case now gets discharged and eventually can ripple about the same value ($5/6 V_{dc}$).</p> <p data-bbox="423 1633 764 1669"><i>See '974 Patent at 6:50-61.</i></p>

Claim 1 of the '710 Patent	Evidence of Infringement
	 <p style="text-align: center;">FIG. 1G</p>
<p>[1g] the power output connections of the plurality of switches being directly connected in series to output a sum voltage approximating the desired AC output voltage and waveform.</p>	<p>The power output connections of the plurality of switches are connected in series to output a sum voltage. This was confirmed by a continuity test performed using an ohmmeter. Moreover, as a practical matter the power output connections are necessarily connected in some fashion and it would not make sense for these outputs to be connected in parallel.</p> <p>This is once again consistent with SolarEdge's patent disclosures. As discussed above in connection with element [1f], the outputs for the plurality of switches are connected in series such that the output of a particular switch either adds the associated voltage to, subtracts the associated voltage from, or contributes zero voltage to, the AC output voltage.</p> <p>The sum voltage approximates a desired AC output voltage and waveform, i.e., a sine wave with a frequency of 60 Hz and a nominal voltage of 240 volts.</p>

Claim 1 of the '710 Patent	Evidence of Infringement																																																																								
	<div><h3>HD-Wave Technology: A New Era for PV Inverters</h3><p>SolarEdge's latest generation of single phase inverters are designed using a novel power conversion technology that is based on a distributed switching and powerful DSP processing. The inverter is able to synthesize a clean sine wave that leads to a dramatic reduction in the magnetics and heavy cooling elements. The result is an even smaller and lighter inverter for simplified shipping and storing, and easy one-person installation. The record-breaking 99% efficiency allows more energy production for an improved ROI.</p><p>See https://www.solaredge.com/us/products/pv-inverter/single-phase#/.</p><p>The AC output has a frequency of 60 Hz.</p><table><tr><th></th><th>SE3000H-US</th><th>SE3800H-US</th><th>SE5000H-US</th><th>SE6000H-US</th><th>SE7600H-US</th><th>SE10000H-US</th><th>SE11400H-US</th><th>Unit</th></tr><tr><td>Maximum output fault current and duration @208V</td><td>-</td><td>17.5 / 20</td><td>-</td><td>27.5 / 20</td><td>-</td><td>-</td><td>56.6 / 20</td><td>A / ms</td></tr><tr><td>AC Frequency (Nominal)</td><td colspan="7">59.3 - 60 - 60.5⁽¹⁾</td><td>Hz</td></tr></table><p>See Installation Guide for Single Phase Inverter with HD-Wave Technology, Version 1.3, at p. 73 (downloaded from https://www.solaredge.com/us/products/pv-inverter/single-phase#/).</p><p>SolarEdge inverters with HD-Wave technology provide a nominal voltage of 240 Volts.</p><table><tr><th></th><th>SE3000H-US</th><th>SE3800H-US</th><th>SE5000H-US</th><th>SE6000H-US</th><th>SE7600H-US</th><th>SE10000H-US</th><th>SE11400H-US</th><th>Unit</th></tr><tr><td colspan="9">OUTPUT</td></tr><tr><td>Rated AC Power Output</td><td>3000</td><td>3800 @ 240V 3300 @ 208V</td><td>5000</td><td>6000 @ 240V 5000 @ 208V</td><td>7600</td><td>10000</td><td>11400 @ 240V 10000 @ 208V</td><td>VA</td></tr><tr><td>Maximum AC Power Output</td><td>3000</td><td>3800 @ 240V 3300 @ 208V</td><td>5000</td><td>6000 @ 240V 5000 @ 208V</td><td>7600</td><td>10000</td><td>11400 @ 240V 10000 @ 208V</td><td>VA</td></tr><tr><td>AC Output Voltage Min.-Nom.-Max. (211 - 240 - 264)</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>✓</td><td>Vac</td></tr></table><p>See Installation Guide for Single Phase Inverter with HD-Wave Technology, Version 1.3, at p. 72 (downloaded from https://www.solaredge.com/us/products/pv-inverter/single-phase#/).</p></div>		SE3000H-US	SE3800H-US	SE5000H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US	Unit	Maximum output fault current and duration @208V	-	17.5 / 20	-	27.5 / 20	-	-	56.6 / 20	A / ms	AC Frequency (Nominal)	59.3 - 60 - 60.5 ⁽¹⁾							Hz		SE3000H-US	SE3800H-US	SE5000H-US	SE6000H-US	SE7600H-US	SE10000H-US	SE11400H-US	Unit	OUTPUT									Rated AC Power Output	3000	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA	Maximum AC Power Output	3000	3800 @ 240V 3300 @ 208V	5000	6000 @ 240V 5000 @ 208V	7600	10000	11400 @ 240V 10000 @ 208V	VA	AC Output Voltage Min.-Nom.-Max. (211 - 240 - 264)	✓	✓	✓	✓	✓	✓	✓	Vac
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30. In April 2018, Koolbridge sent a letter to SolarEdge inviting SolarEdge to consider a joint development or licensing arrangement regarding Koolbridge's inverter technology. The letter included a list of Koolbridge's patents related to its inverter technology. A copy of the letter is attached as Exhibit D and is incorporated herein by this reference. The '822 Patent was identified at the top of that list. Copies of delivery confirmations for the letter are attached as Exhibit E and are incorporated herein by reference. SolarEdge has thus been on notice of the '822 Patent, its applicability to sale of its inverters in the United States and, upon information and belief, its infringement of at least the '822 Patent since at least 2018. Despite this knowledge and presumably knowing it has a duty to avoid knowingly infringing upon the valid and subsisting patent rights of others, that is exactly what SolarEdge has been doing for years. For at least these reasons, SolarEdge's infringement has been and continues to be willful.

FIRST CLAIM FOR RELIEF
(Direct Patent Infringement of U.S. Patent Nos. 8,937,822 and 10,784,710
in violation of 35 U.S.C. § 271(a))

31. Koolbridge incorporates the foregoing paragraphs as if fully set forth herein.

32. SolarEdge made, has made, used, imported, provided, supplied, distributed, sold, imported and/or offered for sale in the United States at least the HD-Wave Inverters, which as outlined in the above charts infringe the asserted patents.

33. By doing so, SolarEdge has directly infringed (literally and/or under the doctrine of equivalents) at least Claims 1, 3, and 6 of the '822 Patent and at least Claims 1, 2, 3, and 6 of the '710 Patent. SolarEdge's infringement in this regard is ongoing and not limited to the representative claims included in the charts.

34. Koolbridge has been damaged as a result of SolarEdge's infringing conduct. Thus, SolarEdge is liable to Koolbridge in an amount that adequately compensates it for such

infringements, which, by law, cannot be less than a reasonable royalty, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

35. SolarEdge's infringement of the Asserted Patents has been and continues to be willful and intentional and with full knowledge of the existence and validity thereof.

36. The willful and intentional nature of SolarEdge's infringement entitles Koolbridge to an award of treble damages pursuant to 35 U.S.C. § 284, and to an award of its attorneys' fees pursuant to 35 U.S.C. § 285.

37. Koolbridge will continue to suffer damages and irreparable harm unless SolarEdge is restrained and enjoined by this Court, pursuant to 35 U.S.C. § 283, from further infringement of the Asserted Patents.

SECOND CLAIM FOR RELIEF

**(Indirect Patent Infringement of U.S. Patent Nos. 8,937,822 and 10,784,710
in violation of 35 U.S.C. §§ 271(b) and (c))**

38. Koolbridge incorporates the foregoing paragraphs as if fully set forth herein.

39. SolarEdge has also indirectly infringed the Asserted Patents by inducing others to directly infringe the Asserted Patent. SolarEdge has induced installers and/or others, including SolarEdge's customers, to directly infringe (literally and/or under the doctrine of equivalents) the Asserted Patents in the United States by installing and using the HD-Wave Inverters. SolarEdge took active steps, directly and/or through contractual relationships with others, with the specific intent to cause them to use the HD-Wave Inverters in a manner that infringes one or more claims of the Asserted Patent, including, for example, Claims 1, 3, and 6 of the '822 Patent and Claims 1, 2, 3, and 6 of the '710 Patent. Such steps by SolarEdge included, among other things, advising or directing installers and others to use the HD-Wave Inverters in an infringing manner; advertising and promoting the use of the HD-Wave Inverters in an infringing manner; and/or distributing

instructions that guide users to use the accused products in an infringing manner. SolarEdge is performing these steps, which constitute induced infringement, with the knowledge of the Asserted Patents and with the knowledge that the induced acts constitute infringement. SolarEdge is aware that the normal and customary use of the HD-Wave Inverters by installers and others (*e.g.*, use in accordance with the instructions provided by SolarEdge), including SolarEdge's customers, infringes the Asserted Patents. SolarEdge's inducement is ongoing.

40. SolarEdge has also indirectly infringed by contributing to the infringement of the Asserted Patents. SolarEdge has contributed to the direct infringement of the Asserted Patents by the installers and other users of the HD-Wave Inverters in the United States. The HD-Wave Inverters have features that are specially designed to be used in an infringing way and that have no substantial uses other than uses that infringe the Asserted Patent, including, for example, Claims 1, 3, and 6 of the '822 Patent and Claims 1, 2, 3, and 6 of the '710 Patent. For example, as relevant to the '822 Patent, the HD-Wave Inverter includes a set of terminals and other components arranged such that when the HD-Wave Inverter is installed in a solar energy system it is capable of producing an AC output waveform and a common-mode voltage waveform as recited in Claim 1 of the '822 Patent. The HD-Wave Inverter has no function other than being installed in an energy system to convert a DC input to an AC output in the manner described in Claim 1 of the '822 Patent. The HD-Wave Inverter's features constitute a material part of the invention of one or more of the claims of the Asserted Patents and are not staple articles of commerce suitable for substantial non-infringing use. SolarEdge's contributory infringement is ongoing.

41. SolarEdge had knowledge of the '822 Patent no later than April 2018 and had knowledge of the '710 Patent no later than the filing of this Complaint.

42. SolarEdge's actions are at least objectively reckless as to the risk of infringing a valid patent and this objective risk was either known or should have been known by SolarEdge.

43. SolarEdge's indirect infringement of one or more of the Asserted Patents is, has been, and continues to be willful, intentional, deliberate, and/or in conscious disregard of Koolbridge's rights under the Asserted Patents.

44. Koolbridge has been damaged as a result of the infringing conduct by SolarEdge alleged above. Thus, SolarEdge is liable to Koolbridge in an amount that adequately compensates it for such infringements, which, by law, cannot be less than a reasonable royalty, together with interest and costs as fixed by this Court under 35 U.S.C. § 284.

45. The willful and intentional nature of SolarEdge's infringement entitles Koolbridge to an award of treble damages pursuant to 35 U.S.C. § 284, and to an award of its attorneys' fees pursuant to 35 U.S.C. § 285.

46. Koolbridge will continue to suffer damages and irreparable harm unless SolarEdge is restrained and enjoined by this Court, pursuant to 35 U.S.C. § 283, from further infringement of the Asserted Patents.

PRAYER FOR RELIEF

Koolbridge requests that the Court find in its favor and against SolarEdge, and that the Court grant Koolbridge the following relief:

A. Judgment that one or more claims of the Asserted Patents have been infringed, either literally and/or under the doctrine of equivalents, by SolarEdge;

B. A permanent injunction enjoining SolarEdge and its officers, directors, agents, servants, affiliates, employees, divisions, branches, subsidiaries, parents, and all others acting in

concert therewith from infringement of the Asserted Patents, or, in the alternative, an award of a reasonable ongoing royalty for future infringement of the Asserted Patents by such entities;

C. Judgment that SolarEdge accounts for and pays to Koolbridge all damages to and costs incurred by Koolbridge because of SolarEdge's infringing activities and other conduct complained of herein, including an award of all increased damages to which Koolbridge is entitled under 35 U.S.C. § 284;

D. That this Court declare this an exceptional case and award Koolbridge its attorneys' fees and costs in accordance with 35 U.S.C. § 285;

E. Pre-judgment and post-judgment interest on the damages caused to it by reason of SolarEdge's infringing activities and other conduct complained of herein; and

F. Such other and further relief as the Court may deem just and proper under the circumstances.

DEMAND FOR JURY TRIAL

Koolbridge hereby requests a trial by jury pursuant to Rule 38 of the Federal Rules of Civil Procedure.

Dated: October 9, 2020

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